WHAT IS CLAIMED IS:

1. A system for inspecting a specimen, comprising:

a contact image sensor, comprising a light source configured to direct light toward a surface of the specimen and a first sensor array configured to detect light returned from the surface of the specimen; and

a processing device coupled to the contact image sensor and configured to analyze information from the detected light and determine a characteristic of the surface of the specimen .

2. The system of claim 1, wherein the light source and the first sensor array are arranged such that the detected light comprises dark field light propagating along a dark field path.

3. The system of claim 1, wherein the light source and the first sensor array are arranged such that the detected light comprises bright field light propagating along a bright field path.

4. The system of claim 1, wherein the contact image sensor further comprises at least one additional sensor array arranged substantially parallel to the first sensor array, wherein the light source and the first sensor array are arranged such that the detected light comprises dark field light propagating along a dark field path, and wherein the light source and at least the one additional linear sensor array are arranged such that the detected light further comprises bright field light propagating along a bright field path.

5. The system of claim 1, wherein the processing device is further configured to determine a location of defects on the surface of the specimen .

6. The system of claim 1, wherein the processing device is further configured to determine a number of defects on the surface of the specimen .

7. The system of claim 1, wherein the processing device is further configured to determine a type of defects on the surface of the specimen .

8. The system of claim 1, wherein the processing device is further configured to determine a location, a number, and a type of defects on the surface of the specimen .

9. The system of claim 1, wherein the defects comprise macro defects having a lateral dimension of greater than approximately 10 μm.

10. The system of claim 1, wherein the surface of the specimen comprises a front side of the specimen.

11. The system of claim 1, wherein the surface of the specimen comprises a back side of the specimen.

12. The system of claim 1, wherein the specimen comprises a wafer.

13. The system of claim 1, wherein the contact image sensor further comprises a fiber optic bundle and a fiber optic line source, wherein the fiber optic bundle is coupled to the light source, and wherein the fiber optic line source is coupled to the fiber optic bundle.

14. The system of claim 1, wherein the contact image sensor further comprises a light pipe, and wherein light source is coupled to the light pipe.

15. The system of claim 1, wherein the light source comprises a linear array of high intensity laser diodes.

16. The system of claim 1, wherein the light source comprises a linear array of light emitting diodes.

17. The system of claim 1, wherein the contact image sensor has a height of less than approximately 30 mm.

18. The system of claim 1, wherein the contact image sensor has a height of approximately 10 mm.

19. The system of claim 1, further comprising a rod lens array to collect light from the specimen, wherein each rod lens of the rod lens array is coupled to one sensor of the first sensor array.

20. The system of claim 1, further comprising a rod lens array to collect light from the specimen, wherein the rod lens array is disposed within the contact image sensor such that the rod lens array is spaced above the surface of the specimen by less than approximately 10 mm.

21. The system of claim 1, further comprising a rod lens array to collect light from the specimen, wherein the rod lens array is disposed within the contact image sensor such that the rod lens array is spaced above the surface of the specimen by less than approximately 3 mm.

22. The system of claim 1, further comprising a rod lens array to collect light from the specimen, wherein each rod lens of the rod lens array is further configured to collect the light returned from the surface at substantially the same collection angle .

23. The system of claim 1, further comprising a rod lens array to collect light from the specimen, wherein each rod lens of the rod lens array comprises a numerical aperture of approximately 0.2 to approximately 0.7.

24. The system of claim 1, wherein the contact image sensor comprises substantially telecentric optics.

25. The system of claim 1, wherein the first sensor array comprises a plurality of linearly aligned sensors, and wherein a pitch of the plurality of linearly aligned sensors comprises approximately 25 μm.

26. The system of claim 1, wherein the first sensor array comprises a plurality of linearly aligned sensors, and wherein a pitch of the plurality of linearly aligned sensors is configured to produce a resolution of greater than approximately 600 dots per inch .

27. The system of claim 1, wherein the first sensor array comprises a plurality of linearly aligned sensors, and wherein a pitch of the plurality of linearly aligned sensors is configured to produce a resolution of approximately 1200 dots per inch .

28. The system of claim 1, wherein the contact image sensor further comprises a circuit substrate coupled to the first sensor array, and wherein the circuit substrate comprises circuitry configured to produce a dynamic range of greater than approximately 12 bits .

29. The system of claim 1, wherein the contact image sensor comprises a length of at least a diameter of the specimen, and wherein the diameter of the specimen comprises greater than approximately 200 mm.

30. The system of claim 1, wherein the contact image sensor comprises a length of at least a diameter of the specimen, and wherein the diameter of the specimen comprises approximately 300 mm.

31. The system of claim 1, wherein the processing device is further configured to calibrate the first sensor array for pixel gain variation and sensor distortion .

32. The system of claim 1, wherein the contact image sensor further comprises a closed loop bar assembly.

33. The system of claim 1, wherein the system further comprises a support device configured to hold a specimen , and wherein the support device is configured to impart relative motion to the specimen .

34. The system of claim 1, wherein the contact image sensor is configured to move with respect to the specimen .

35. The system of claim 1, wherein the system further comprises a plurality of contact image sensors, and wherein a first of the plurality of contact image sensors is arranged above a second of the plurality of contact image sensors.

36. The system of claim 1, wherein the system further comprises a plurality of contact image sensors, and wherein the system is further configured to inspect a plurality of specimens substantially simultaneously .

37. The system of claim 1, wherein the system further comprises a plurality of contact image sensors, and wherein a first of the plurality of contact image sensors are arranged laterally adjacent to a second of the plurality of contact image sensors.

38. The system of claim 1, wherein the system further comprises a plurality of contact image sensors, wherein a first of the plurality of contact image sensors are arranged laterally adjacent to a second of the plurality of contact image sensors, and wherein the plurality of contact image sensors has a lateral area equal to approximately a surface area of the specimen.

39. The system of claim 1, wherein the contact image sensor is coupled to a process tool, and wherein the process tool is configured to fabricate at least a portion of a semiconductor device .

40. The system of claim 1, wherein the processing device is further coupled to a process tool, and wherein the processing device is further configured to alter at least one parameter of an instrument coupled to the process tool in response to the determined presence of defects .

41. A system configured to inspect a specimen , comprising:

a contact image sensor disposed above a surface of the specimen such that the rod lens array is spaced above the surface of the specimen by less than approximately 10 mm, wherein the contact image sensor has a height of less than approximately 10 mm, the contact image sensor comprising:

a light source configured to direct light toward the surface of the specimen ;

a rod lens array configured to collect light returned from the surface of the specimen, wherein a collection angle of each rod lens is substantially equal, and wherein the contact image sensor comprises an optical configuration for telecentric collection of specimen images by the rod lens array; and

a first sensor array configured to detect light collected by the rod lens array , wherein each rod lens is coupled to one sensor of the first sensor array; and

a processing device coupled to the contact image sensor and configured to determine a presence of defects on the surface of the specimen using the detected light .

~~42.~~ ~~A method for inspecting a specim~~en, comprising:

directing light from a light source toward a surface of the specimen;

collecting light returned from the surface of the specimen;

detecting the collected light using a first sensor array, wherein the light source, and the first sensor array are coupled in a contact image sensor; and

determining a presence of defects on the surface of the specimen from the detected light.

43. The method of claim 42, wherein detecting the collected light comprises detecting dark field light propagating along a dark field path or detecting bright field light propagating along a bright field path.

44. The method of claim 42, wherein detecting the collected light comprises detecting dark field light propagating along a dark field path and detecting bright field light propagating along a bright field path.

45. The method of claim 42, wherein detecting the collected light comprises detecting dark field light propagating along a dark field path and detecting bright field light propagating along a bright field path, wherein detecting the dark field light comprises using the first sensor array, wherein detecting the bright field light comprises using an additional linear sensor array, and wherein the additional linear sensor array is arranged substantially parallel to the first sensor array in the contact image sensor.

46. The method of claim 42, further comprising determining a location of defects on the specimen.

47. The method of claim 42, further comprising determining a number of defects on the surface of the specimen.

48. The method of claim 42, further comprising determining a type of defects on the surface of the specimen.

49. The method of claim 42, further comprising determining a location, a number, and a type of defects on the surface of the specimen.

50. The method of claim 42, wherein the defects comprise macro defects having a lateral dimension of greater than approximately 10 μm.

51. The method of claim 42, wherein the surface of the specimen comprises a front side of the specimen.

52. The method of claim 42, wherein the surface of the specimen comprises a back side of the specimen.

53. The method of claim 42, wherein the specimen comprises a wafer.

54. The method of claim 42, wherein the contact image sensor comprises a fiber optic bundle and a fiber optic line source, wherein the fiber optic bundle is coupled to the light source, and wherein the fiber optic line source is coupled to the fiber optic bundle.

55. The method of claim 42, wherein the contact image sensor comprises a light pipe, and wherein the light source is coupled to the light pipe.

56. The method of claim 42, wherein the light source comprises a linear array of high intensity laser diodes.

57. The method of claim 42, wherein the light source comprises a linear array of light emitting diodes.

58. The method of claim 42, wherein the contact image sensor has a height of less than approximately 30 mm.

59. The method of claim 42, wherein the contact image sensor has a height of approximately 10 mm.

60. The method of claim 42, wherein said light is collected using a rod lens array, and wherein each rod lens of the rod lens array is coupled to one sensor of the first sensor array.

61. The method of claim 42, wherein said light is collected using a rod lens array, and wherein the rod lens array is disposed within the contact image sensor such that the rod lens array is spaced above the surface of the specimen by less than approximately 10 mm.

62. The method of claim 42, wherein said light is collected using a rod lens array, and wherein the rod lens array is disposed within the contact image sensor such that the rod lens array is spaced above the surface of the specimen by approximately 3 mm.

63. The method of claim 42, wherein said light is collected using a rod lens array, and further comprising collecting the light returned from the surface with each rod lens of the rod lens array at substantially the same collection angle.

64. The method of claim 42, wherein said light is collected using a rod lens array, and wherein each rod lens of the rod lens array comprises a numerical aperture of approximately 0.2 to approximately 0.7.

65. The method of claim 42, wherein the contact image sensor comprises substantially telecentric optics.

66. The method of claim 42, wherein the first sensor array comprises a plurality of linearly aligned sensors, and wherein a pitch of the plurality of linearly aligned sensors comprises approximately 25 μm.

67. The method of claim 42, wherein the first sensor array comprises a plurality of linearly aligned sensors, and wherein a pitch of the plurality of linearly aligned sensors produces a resolution of greater than approximately 600 dots per inch.

68. The method of claim 42, wherein the first sensor array comprises a plurality of linearly aligned sensors, and wherein a pitch of the plurality of linearly aligned sensors produces a resolution of approximately 1200 dots per inch.

69. The method of claim 42, wherein the contact image sensor further comprises a circuit substrate coupled to the first sensor array, and wherein the method further comprises producing a dynamic range of greater than approximately 12 bits with circuitry formed on the circuit substrate.

70. The method of claim 42, wherein the contact image sensor has a length of at least a diameter of the specimen, and wherein the diameter of the specimen comprises greater than approximately 200 mm.

71. The method of claim 42, wherein the contact image sensor has a length of at least a diameter of the specimen, and wherein the diameter of the specimen comprises approximately 300 mm.

72. The method of claim 42, further comprising calibrating the first sensor array for pixel gain variation and sensor distortion prior to said detecting.

73. The method of claim 42, wherein the contact image sensor comprises a closed loop bar assembly.

74. The method of claim 42, further comprising moving the specimen with respect to the contact image sensor during said directing and said detecting.

75. The method of claim 42, further comprising moving the contact image sensor with respect to the specimen during said directing and said detecting.

76. The method of claim 42, further comprising inspecting a plurality of specimens substantially simultaneously with a plurality of contact image sensors.

77. The method of claim 42, further comprising inspecting a plurality of specimens substantially simultaneously with a plurality of contact image sensors, wherein a first of the plurality of contact image sensors is arranged above a second of the plurality of contact image sensors.

78. The method of claim 42, further comprising inspecting a plurality of specimens substantially simultaneously with a plurality of contact image sensors, wherein a first of the plurality of contact image sensors is arranged laterally adjacent to a second of the plurality of contact image sensors.

~~79. The method of claim 42, further comprising inspecting a plurality of specimens substantially simultaneously with a plurality of contact image sensors, wherein a first of the plurality of contact image sensors is arranged laterally adjacent a second of the plurality of contact image sensors, and wherein the plurality of contact image sensors comprises a lateral area approximately equal to a surface area of the specimen.~~

~~80. The method of claim 42, wherein the contact image sensor is coupled to a process tool, the method further comprising altering at least one parameter of an instrument coupled to the process tool using the determined presence of defects on the surface of the specimen.~~

81. A method for inspecting a specimen, comprising:

directing light from a light source toward a surface of the specimen;

collecting light returned from the surface of the specimen using a rod lens array, wherein each rod lens of the rod lens array comprises a diameter of approximately 10 microns, and wherein a collection angle of each rod lens is substantially equal;

detecting the collected light using a first sensor array, wherein the light source, the rod lens array, and the first sensor array are arranged in a contact image sensor, wherein each rod lens is coupled to one sensor of the first sensor array, wherein the contact image sensor is disposed above a surface of the specimen such that the rod lens array is spaced above the surface of the specimen by less than approximately 10 mm, wherein the contact image sensor comprises a height of approximately 10 mm, and wherein the contact image sensor comprises an optical configuration for telecentric collection of specimen image by the rod lens array; and

determining a presence of defects on the surface of the specimen from the detected light.

82. A method for inspecting a specimen between two process steps, comprising:

transporting the specimen from a first process chamber to a second process chamber;

directing light from a light source toward a surface of the specimen during said transporting;

collecting light returned from the surface of the specimen during said transporting;

detecting the collected light using a first sensor array during said transporting, wherein the light source, and the first sensor array are arranged in a contact image sensor; and

determining a presence of defects on the surface of the specimen from the detected light.

83. The method of claim 82, wherein the first process chamber and the second process chamber are coupled to a semiconductor fabrication process tool.

84. The method of claim 82, wherein the first process chamber and the second process chamber are coupled to a semiconductor fabrication process tool, and wherein the

semiconductor fabrication process tool comprises a chemical-mechanical polishing tool, an etch tool, a deposition tool, a lithography tool, or an ion implantation tool.

85. The method of claim 82, wherein the first process chamber is coupled to a first semiconductor fabrication process tool, and wherein the second process chamber is coupled to a second semiconductor fabrication process tool.

86. A semiconductor device fabricated by a method, the method comprising:

forming a portion of the semiconductor device upon a wafer;

directing light from a light source toward a surface of the portion of the semiconductor device;

collecting light returned from the surface of the portion of the semiconductor device using a rod lens array;

detecting the collected light using a first sensor array, wherein the light source, the rod lens array, and the first sensor array are arranged in a contact image sensor; and

determining a presence of defects on the surface of the portion of the semiconductor device from the detected light.

87. A method for fabricating a semiconductor device, comprising:

forming a portion of the semiconductor device upon a specimen;

directing light from a light source toward a surface of the portion of the semiconductor device;

collecting light returned from the surface of the portion of the semiconductor device using a rod lens array;

detecting the collected light using a first sensor array, wherein the light source, the rod lens array, and the first sensor array are arranged in a contact image sensor; and

determining a presence of defects on the surface of the portion of the semiconductor device from the detected light.

88. A computer-implemented method for controlling a system configured to inspect a specimen , wherein the system comprises a contact image sensor, the method comprising:

controlling the contact image sensor, wherein the contact image sensor comprises a light source, a rod lens array, and a first sensor array, comprising:

controlling the light source to direct light toward a surface of the specimen;

collecting light returned from the surface of the specimen y; and

controlling the first sensor array to detect the collected light; and

processing the detected light to determine a presence of defects on the surface of the specimen.

89. The method of claim 88, wherein the contact image sensor further comprises a fiber optic bundle and a fiber optic line source, wherein the fiber optic bundle is coupled to the light source, and wherein the fiber optic line source is coupled to the fiber optic bundle.

90. The method of claim 88, wherein the contact image sensor further comprises a light pipe, and wherein the light source is coupled to the light pipe.

91. The method of claim 88, wherein the contact image sensor further comprises a height of less than approximately 30 mm.

92. The method of claim 88, wherein the contact image sensor further comprises a height of approximately 10 mm.

93. The method of claim 88, wherein said light is collected using a rod lens array, and wherein each rod lens of the rod lens array is coupled to one sensor of the first sensor array.

94. The method of claim 88, wherein said light is collected using a rod lens array, and wherein rod lens array is disposed within the contact image sensor such that the rod lens array is spaced above the surface of the specimen by less than approximately 10 mm.

95. The method of claim 88, wherein said light is collected using a rod lens array, and wherein the rod lens array is disposed within the contact image sensor such that the rod lens array is spaced above the surface of the specimen by less than approximately 3 mm.

96. The method of claim 88, wherein said light is collected using a rod lens array, and wherein the rod lens array is configured to collect light at substantially the same collection angle.

97. The method of claim 88, wherein said light is collected using a rod lens array, and wherein each rod lens of the rod lens array comprises a numerical aperture of approximately 0.2 to approximately 0.7.

98. The method of claim 88, wherein contact image sensor comprises substantially telecentric optics.

99. The method of claim 88, wherein the first sensor array comprises a plurality of linearly aligned sensors, and wherein a pitch of the plurality of linearly aligned sensors comprises approximately 25 μm.

100. The method of claim 88, wherein the first sensor array comprises a plurality of linearly aligned sensors, and wherein a pitch of the plurality of linearly aligned sensors produces a resolution of greater than approximately 600 dots per inch.

101. The method of claim 88, wherein the contact image sensor further comprises a circuit substrate coupled to the first sensor array, and wherein the circuit substrate comprises circuitry configured to produce a dynamic range of greater than approximately 12 bits .

102. The method of claim 88, wherein the contact image sensor comprises a length of at least a diameter of the specimen, and wherein the diameter of the specimen comprises greater than approximately 200 mm.

103. The method of claim 88, further comprising controlling the contact image sensor to calibrate the first sensor array for pixel gain variation and sensor distortion.

104. The method of claim 88, wherein the contact image sensor comprises a closed loop bar assembly.

105. The method of claim 88, further comprising controlling a support device to move the specimen with respect to the contact image sensor.

106. The method of claim 88, further comprising controlling the contact image sensor to move the contact image sensor with respect to the specimen.

107. The method of claim 88, wherein the system further comprises a plurality of contact image sensors, the method further comprising controlling the plurality of contact image sensors.

108. The method of claim 88, wherein the contact image sensor is coupled to a process tool, the method further comprising altering at least one parameter of an instrument coupled to the process tool using the determined presence of defects on the surface of the specimen.

109. An apparatus for inspecting a substrate, comprising:

a. a light source for illuminating at least a portion said substrate;

b. optics for collecting light from said illuminated portion;

c. a plurality of sensors for sensing said collected light; and

d. a processor for determining the presence of a defect or process variation on said substrate, wherein said optics and said sensors and at least a

portion of said light source are contained in an integrated package proximate to said substrate.

110. The apparatus of claim 109, wherein the existence of said defect is determined by comparing said portion of said substrate with another, nominally identical portion of said substrate.

111. The apparatus of claim 110, wherein said substrate includes a plurality of semiconductor dies, and said portion of said substrate is contained on one of said dies and said nominally identical portion is contained on another of said dies.

112. The apparatus of claim 110, wherein said substrate includes an array of substantially identical elements, and said portion of said substrate is contained in a first region of said array and said nominally identical portion is contained a second region of said array.

113. The apparatus of claim 112, wherein said first and second region are contained within a single semiconductor die.

114. A method of inspecting a substrate, comprising inspecting said substrate with a contact image sensor to detect defects on said substrate.

115. The method of claim 114, wherein said substrate is a semiconductor wafer.

116. The method of claim 115, wherein both a front and a back side of said wafer are inspected.

117. The method of claim 114, wherein said inspection is a macro defect inspection.

118. A method of inspecting a substrate, comprising:

a. illuminating at least a portion of said substrate;

b. collecting light from said portion, and transmitting said collected light to a plurality of sensors at approximately a 1:1 magnification;

c. processing data from said sensors to determine the existence of defects or process variations within said portion.

119. The method of claim 118, wherein said data is processed to detect macro defects within said portion.